ULTRAVIOLET SPECTRA OF ORGANIZED ELEMENTS IN THE ORGUEIL METEORITE DETERMINED WITH THE ULTRAMICROSPECTROGRAPH

The ultraviolet absorption spectra of the acid insoluble residues of individual "organized elements" have been studied with a Universal ultramicrospectrograph. The spectra of an area as small as 1 μ in diameter may be determined with this instrument (1, 2).

The meteorite microstructures, that is, the organized elements, were examined in petrographic thin sections and also in powdered preparations of two stones of the Orgueil carbonaceous meteorite (from the Montauban Museum in France). The thin sections were prepared by grinding and polishing undisturbed fragments of the stones. This process insured that organized elements found embedded in the newly exposed interior of the meteorite were not recent terrestrial biological contaminations.

It has been reported (3), that some organized elements are mineralized with acid-soluble iron compounds. Consequently, a chemical treatment was employed to remove these compounds as well as some other mineral constituents. The petrographic thin sections were mounted on quartz slides with "Eastman-910 Adhesive" without cover slips, and subsequently they were extracted with chloroform, and with 0.5 N HCl for a period of 15 hours.

The powdered meteorite samples were boiled in oxalic acid for an hour, washed with 0.5 N HCl, boiled in conc. HF for two hours, and finally washed with cold nitric acid in order to remove iron compounds, silicates, and any MgF_2. Some of these samples were also extracted with chloroform at room temperature for 15 hours. The possibility of recent biological contamination in such powdered [illegible] not be completely excluded. However, the similar results obtained [illegible] both thin sections and powdered samples

in this investigation and also in earlier microprobe work (3) makes this possibility most unlikely.

Generally, the UV spectra of the acid-insoluble residues of individual organized elements showed absorption bands in the 2600-2800 Å wavelength range (Figures 1 and 2). Mineral standards were analyzed for comparison but gave quite different spectra (Figure 1). Some of these minerals were selected because they were resistant to HF. Chloroform extraction of the organized elements did not appear to change their spectra, which suggests that the acid-insoluble residues were not composed of bituminous matter or of low molecular weight hydrocarbons. However, there are several other compounds, including nucleic acids and proteins, which have absorption bands in the 2600-2800 Å wavelength range.

The organized elements investigated in thin sections were of "types 1 and 2" (4), 8-11 μ in diameter, brownish-yellow in color, and probably filled with limonite (3). The organized elements were opaque in the UV range before acid leaching was employed to remove their mineral content, which further demonstrates that these microstructures were not recent terrestrial biological contaminants. These same particles appeared as colorless insoluble residues after acid leaching; these residues gave UV spectra (a in Figure 2) similar to those of the organized elements found in the powdered samples (a and b in Figure 1). The main mineral constituents of the meteorite remained opaque in UV. The thin section was then treated with a solution of ribonuclease (1 mg in 1 ml of water) at 37°C for 15 hours, resulting in lower extinction for the same particle (curve b in Figure 1). The action of the enzyme on the organized element has not been fully ascertained because of experimental difficulties and a lack of understanding of enzymatic behavior in mineral systems.

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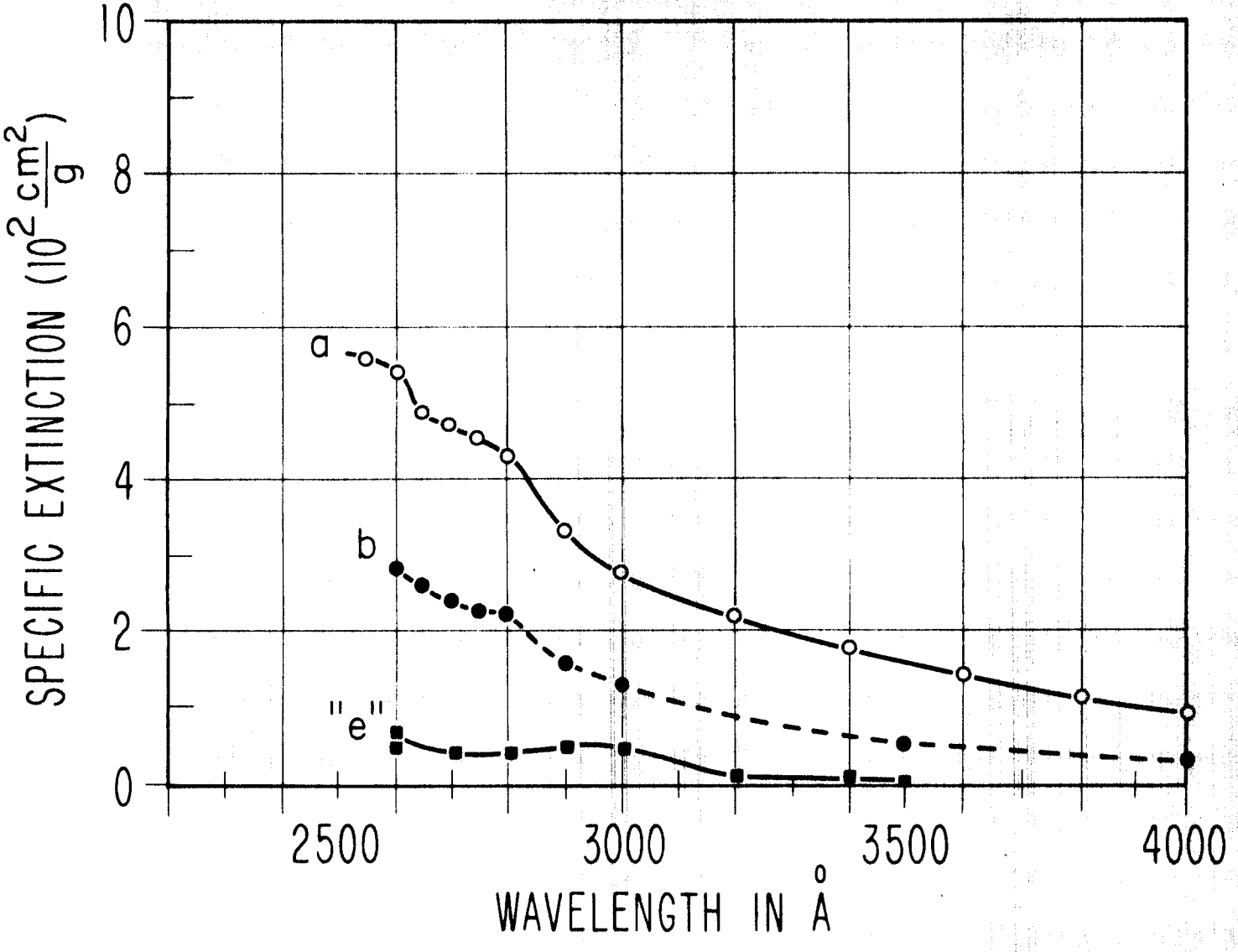
CAPTIONS FOR DIAGRAMS

Figure 1. UV absorption spectra of acid resistant residues of organized elements from powdered preparations of the Orgueil meteorite, a and b. UV absorption spectra of mineral standards: c, fluorite from Kongsberg, Norway, d, apatite from Risor, Norway, e, spinel (Mg, Al) from Ceylon. Rutile and limonite standards as well as the main Orgueil minerals were opaque in the UV range. Specific extinction is defined as extinction divided by mass per unit area. The thickness of the minerals was determined by interference microscopy; the thickness and density of organized element residues were estimated from microscopic observations and from earlier unpublished results.

Figure 2. UV absorption spectra of the acid resistant residue of an organized element embedded in a petrographic thin section; a, before, b, after enzyme treatment. The thickness of the particle was estimated to be approximately 5 u, based on the thickness of the corresponding portion of the section. The density was assumed to be ~1.4 according to previous unpublished results. Curve "e" (spinel) was replotted from Figure 1 to demonstrate the considerably lower extinction of the mineral standards.


SPECIFIC EXTINCTION ($10^2 \frac{cm^2}{g}$)
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8
6
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a
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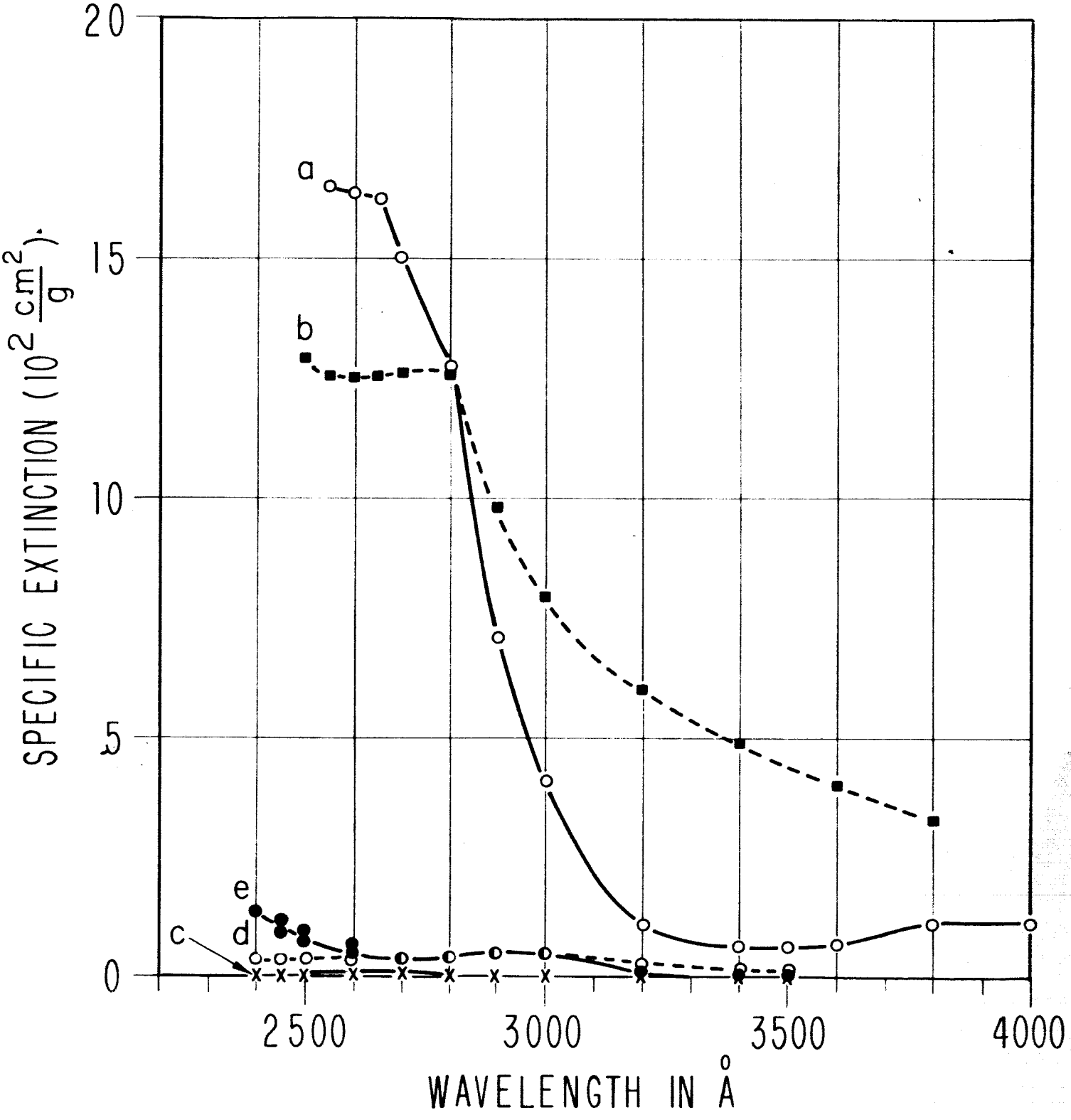
WAVELENGTH IN Å


20
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SPECIFIC EXTINCTION ($10^2 \frac{cm^2}{g}$).
a
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